Stewart 1925

CIRCULAR NO. 82

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION

GENEVA, N. Y.

IMPERIAL MYCOLOGICAL INSTITUTE 2 JUL 1945

HOW TO KNOW THE MUSHROOMS AND TOADSTOOLS

INTRODUCTION

It is a matter of common knowledge that a considerable number of the numerous kinds of fleshy fungi which grow so abundantly in the woods, pastures, and lawns are edible. It is also well known that some of them are deadly poisonous. Being unable to distinguish the edible from the poisonous kinds, the great majority of people dare not make any use of wild mushrooms for food. Consequently, large quantities of excellent food of this kind go to waste at our very doors.

Nevertheless, interest in the subject appears to be widespread and information much sought after. This circular has been prepared for the use of beginners in mushroom study. It makes no pretense of completeness—it is merely a brief, non-technical introduction to the subject. Its chief purpose is to explain how one should proceed who wishes to become acquainted with the mushrooms and toadstools.

THEIR NATURE

Mushrooms and toadstools are plants. They belong to the lowly class of plants known as fungi. Because of their flesh-like texture they are frequently called fleshy fungi. In common parlance, those kinds which may be safely eaten are mushrooms, while the poisonous kinds are toadstools; but the mycologist usually speaks of them as edible and poisonous fungi. They differ from the higher plants in two important respects: (1) They lack green coloring matter (chrolophyll) and hence are unable to obtain the carbon required for their growth direct from the air as do green plants; and (2) they reproduce by means of spores instead of by seeds. They have no true roots, but are nourished by means of delicate threads which penetrate the substance upon which they grow and form an extensive network of mold known as the mycelium or spawn. Some kinds grow upon the ground and

feed upon the vegetable matter in the soil. Others grow upon or about dead wood (stumps, logs, etc.) and are important factors in its decay. Still others live parasitically upon living trees causing diseases known as root rot, trunk rot, heart rot, etc.

NUMBER OF KINDS

It is estimated that in the whole world there are upwards of 10,000 different kinds (species) of fleshy fungi. Even within the limits of the State of New York probably more than 1,000 species may be found. However, a considerable number of these occur but rarely or are of quite restricted distribution. Altho many of the less common kinds have not yet been thoroly tested for edibility, it is safe to say that the great majority of the many different kinds are either edible or harmless. The number of poisonous species is quite small. In fact, the deadly poisonous species are confined to a single genus (*Amanita*) and are few in number. Unfortunately, two of the deadly species, *Amanita phalloides* and *Amanita muscaria*, are of frequent occurrence in New York.

Dr. Charles H. Peck, who was State Botanist of New York for about 40 years and became one of the leading American authorities on fleshy fungi, has described and illustrated, in various bulletins and reports of the New York State Museum of Natural History, 195 species of edible New York fungi and 5 others which are either poisonous or unwholesome. An alphabetical list of these with literature references was published in Bulletin No. 139 of the Museum. A majority of the 195 edible species on this list occur too infrequently or too sparingly to be of economic importance. Considering their size, frequency of occurrence, and quality, there are, probably, not more than 50 species of edible fungi in the State which are of real economic importance. Not all of these are found in any one locality. Certain species common in one part of the State may be scarce or even wholly lacking in another part.

UNRELIABLE EDIBILITY TESTS

When the subject of edible fungi is under discussion the novice is almost certain to inquire, "How do you tell a mushroom from a toadstool?" The idea back of this question appears to be that all edible fungi have some peculiarity which marks them as edible, and

that all poisonous fungi have some peculiarity which marks them as poisonous. Or, perhaps, that there is some simple test which will determine whether they are edible or poisonous. Unfortunately, there are many fungus eaters who claim to know such signs and tests. A vast amount of dangerous misinformation is given out by people who know and eat a few species and therefore regard themselves as authorities. Almost every community has one or more of these mushroom "authorities" who believe in signs and tests. Beware of them!

None of the popular mushroom "tests" are reliable. There are several of them, but it seems sufficient to speak in detail of but one, namely, the so-called silver test. This has been in vogue for centuries and is still frequently used. It consists in placing a silver spoon (or other silver object) in the dish in which the fungi are being cooked. If the silver becomes blackened the fungi are pronounced toadstools and discarded as poisonous; but if it does not tarnish the fungi are mushrooms and safe to eat. This test will detect decomposition and, to that extent, is useful. But as a means of distinguishing between poisonous and non-poisonous species of fungi it is not merely useless but dangerous, because even one of the most deadly species, *Amanita phalloides*, will not discolor silver if cooked while in fresh condition.

THE RIGHT WAY

The right way to proceed is to learn to recognize the different kinds of edible and poisonous fungi at sight in the same way that one recognizes other plants such as peas, beans, poison ivy, and water hemlock. *One must learn to recognize at sight each kind of fungus which he eats and never eat anything which he does not know.*

Let us suppose that the prospective fungus eater finds a quantity of some fungus whose acquaintance he would like to make because it looks as if it might be good to eat. The first thing to do is to make careful observations of the appearance of its different parts, for example, the size, shape, color, and markings of the cap, whether it is smooth, hairy, scaly, or viscid (when moist); the shape, color, width and closeness of the gills and the manner in which they are attached to the stem; the color of the spores (spore print); the character of the stem, its length, diameter, shape, and markings, whether fleshy, fibrous, or brittle, smooth, hairy or scaly, solid, hollow, or stuffed,

naked, or provided with a collar (annulus), with or without a cup (volva) at the base; its taste, odor, place and habit of growth, season and appearance, etc. It is well to make full written notes of these matters and sketching the plants will help greatly to fix them in the mind. When practicable, it is desirable, also, to make photographs of the plants and to dry and preserve specimens.

At this point one or both of two courses may be taken: (1) Find somebody who knows the fungus, or (2) learn its name from books. The first method is often the easier one and quite satisfactory if one merely wishes to learn a few of the edible and poisonous species. In almost every community there are a few persons who know and eat a few kinds of fleshy fungi. If somebody can be found who has actually eaten some of the same kind of fungus without harm, it is safe to eat a little of it as an experiment for, generally speaking, what one has eaten safely another may. Then, if the fungus proves to be safe and palatable further experiments may be made with larger quantities so that the next time it is encountered there need be no doubt as regards either its identity or its edibility.

Should it happen that nobody can be found who knows the fungus, specimens of it may be sent away to an expert. The writer will be glad to identify such specimens for residents of New York. They may be addressed to F. C. Stewart, Agricultural Experiment Station, Geneva, N. Y. Specimens to be sent thru the mail should be perfectly fresh, and each plant separately wrapped in tissue paper, never in cotton batting, and packed in stout tin or wooden boxes to avoid crushing in transit.

EATING TESTS

The edibility of an unknown fungus may be tested by actually eating some of it in the manner described by Gibson in his book, "Our Edible Toadstools and Mushrooms," which will be noticed later.

"Begin by a mere nibble, the size of a pea, and gentle mastication, being careful to swallow no saliva, and finally expelling all from the mouth. If no noticeable results follow, the next trial, with the interval of a day, with the same quantity may permit of a swallow of a little of the juice, the fragments of the fungus expelled as before.

"No unpleasantness following for twenty-four hours, the third trial may permit of a similar entire fragment being swallowed, all of

these experiments to be made on 'an empty stomach.' If this introduction of the actual substance of the fungus into the stomach is superseded by no disturbance in twenty-four hours, a larger piece, the size of a hazel-nut, may be attempted, and thus the amount gradually increased day by day until the demonstration of edibility, or at least harmlessness, is complete, and the species thus admitted into the 'safe' list. By following this method with the utmost caution the experimentor can at best suffer but a slight temporary indisposition as the result of his hardihood, in the event of a noisome species having been encountered, and will at least have the satisfaction of the discovery of any enemy if not a friend.

"It may be said that any mushroom, *omitting the Amanita*, which is pleasant to the taste and otherwise agreeable as to odor and texture when raw, is probably harmless, and may safely be thus *ventured on* with a view of establishing its edibility."

The above program should neither be varied nor hurried. If the fungus spoils before the test can be completed there is nothing to be done except to wait until some more of the same kind of fungus can be found.

Fungi which at the first trial are found bitter or acrid should be cooked and re-tested before they are finally discarded. Frequently, bitterness and acridity completely disappear in the process of cooking.

USE OF BOOKS

One cannot expect to go far in the study of fleshy fungi without recourse to books. Opinions will differ as to which books are best suited to the needs of the beginner. Our own experience leads us to recommend first of all, "Our Edible Toadstools and Mushrooms and How to Distinguish Them," by W. Hamilton Gibson, published by Harper and Brother, New York and London. This is a book of 337 pages written in popular style. Next in order comes, "Mushrooms, Edible, Poisonous, etc.," by G. F. Atkinson, published by Andrus and Church, Ithaca, N. Y. This is a technical introduction to the subject. Besides descriptions of many common species it contains numerous fine illustrations, a glossary of technical terms, analytical keys for the identification of the common genera of the gill fungi, and chapters on the collection and preservation of fungi, recipes for cooking mushrooms, mushroom poisoning, and the structure of mushrooms.

For the study of New York fleshy fungi certain of the bulletins and reports of the New York State Museum of Natural History are indispensable. These contain the mycological writings of Dr. Charles H. Peck previously mentioned. Information concerning "Peck's Reports," as these publications are called, may be obtained from the Office of the State Botanist, Albany, N. Y.

Another useful work is the "Agaricaceae of Michigan" by Dr. C. H. Kauffman. This was published as a part of the annual report of the Geological and Biological Survey of Michigan for 1918. It is in two volumes. The first volume contains descriptions of 884 species of gill fungi growing in the State of Michigan, together with keys for their identification. Also, a glossary of technical terms and a chapter on mushroom poisoning. The second volume contains 172 plates illustrating the species described.

Several other books might be named but those mentioned above will serve the purposes of the beginner for a long time.

TECHNICAL TERMS AND LATIN NAMES

One may readily learn to recognize a few common species without giving any attention to technical terms or Latin names. But he who would qualify as an expert must learn the meaning of a considerable number of technical terms used in the description of fungi. He must also learn the Latin names of the different species. Many species have no common name. They are known exclusively by their Latin or botanical name. A knowledge of the technical terms and Latin names used is necessary if one is to understand what he reads in books about fleshy fungi.

MAGNIFIERS AND MICROSCOPES

A small hand lens or magnifier which magnifies about ten diameters and is provided with a folding handle so that it may be conveniently carried in the pocket is indispensable to the student of fleshy fungi. He uses it constantly for observations of the finer markings and structural features not readily discerned by the unaided eye.

Formerly, descriptions of fleshy fungi included only their gross characters, such as may be seen with the unaided eye or with low-power magnifiers; but in recent years mycologists are more and more making use of microscopic characters. The size, shape, and markings

of the spores; the presence or absence of cystidia or other sterile cells in the hymenium, and their size and shape if present; the size and shape of the basidia; the number of sterigmata; and other minute structural characters are now recorded in descriptions and are often very helpful in the separation of closely related species. Accordingly, a compound microscope which will give a magnification of 300 or 400 diameters is a highly useful adjunct to the study of fleshy fungi.

SPORE PRINTS

In the study of Agarics (gill fungi) it is a matter of first importance to determine the color of the spores. Often the color of the gills is a good indication of the color of the spores, but there are so many exceptions to this rule that even the experienced mycologist frequently finds it necessary to make what are known as spore prints. The beginner will find spore prints very interesting as well as useful in determining the color of spores.

Spore prints are made in the following manner: The stem of the mushroom is cut off close to the cap and the cap placed gills downward on paper and then closely covered with an inverted tumbler, bowl or other similar dish. In from 6 to 12 hours the cap is uncovered and carefully lifted from the paper. It will then be found that the spores of the mushroom have been deposited in a thin layer upon the paper and in such manner as to make a perfect pattern showing the arrangement of the gills. For the best results the caps should be nearly, but not quite, mature and the covering dish should fit closely to the paper all around so as to exclude the air and prevent the cap from drying out. If colored spores are expected the paper used should be white, but white spores show best on black paper. In doubtful cases the cap may be placed partly over white paper and partly over black paper. By using gummed paper one can obtain fairly permanent spore prints which may be preserved for future reference. However, the colors are liable to change somewhat with age.

THE POISONOUS AMANITAS

Since the most poisonous of the fleshy fungi are species of *Amanita*, it is held by some authors that the very first concern of the mycophagist (fungus eater) should be to learn thoroly the characters of the genus *Amanita*. With this idea the present writer is in full accord.

Descriptions and illustrations of the Amanitas are to be found in nearly all of the books on edible fungi. The beginner should study them carefully. Also, he should take the first opportunity to study the live plants. Amanitas may be handled with impunity. They are not poisonous to the touch. Here, it is perhaps sufficient to state that three of the essential characters of the Amanita are: (1) White spores (gills white, whitish, or yellow-tinged); (2) a collar or ring (annulus) on the upper part of the stem; and (3) the base of the stem surrounded by a cup or sheath (volva). In some species the volva is quite rudimentary and inconspicuous or represented by rings of scales.

A DOZEN COMMON EDIBLE FUNGI

To give full descriptions of even a few of the many kinds of edible fungi would take us beyond the limits set for this circular. However, it seems desirable to give the habitat and outstanding features of a few of the more important species whose acquaintance the beginner will certainly wish to make. The following list contains a dozen good edible species which are common in our State. Everybody should learn to know them; and nobody who uses his eyes to look for the combination of *white spores*, *white gills*, *ring*, *and volva* which characterize the *Amanita* need mistake a poisonous *Amanita* for any of them.

1. Of the **Morels** (*Morchella* spp.) there are, perhaps, half a dozen kinds which vary considerably in size, shape, and color, yet all are so similar in general appearance and so different from other fungi that once they are recognized there is no need of mistaking anything else for them. The caps are covered all over with large deep pits separated by a network of anastomosing ridges. The stem is usually one-half inch or more in diameter, thin-walled, and hollow, with a large cavity which extends upward into the cap. Morels grow on the ground in thin woods, hedgerows, bushy places, and neglected grassy orchards. They are found only during the month of May.

2. The **Mica Ink-cap** or **Glistening Coprinus** (*Coprinus micaceus*) is a small buff-yellow mushroom growing in dense clusters of many individuals on the ground around stumps or over buried wood. It is found from May to October in several successive crops if there is plenty of rain. It is known by the minute glistening particles which thickly cover the gills of young plants and by the inky black liquid produced during the disintegration of the old caps.

3. In the **Large Ink-cap** (*Coprinus atramentarius*) the young caps, when in edible condition, are grayish or grayish-brown in color, and usually about the size and shape of a hen's egg. At maturity the gills deliquesce into inky black liquid as in the Mica Ink-cap. They grow in dense clusters about stumps and over buried wood. Less frequently, they are found in rich soil in gardens, lawns, and about barnyards where their relation to wood is not evident. The spores are black.

4. The **Shaggy Mane** (*Coprinus comatus*) is another ink-cap fungus. The young caps are cylindrical, 2 to 5 inches tall, by about an inch in diameter, whitish, and covered with loose fibrils and darker scales which give a shaggy appearance suggestive of the name. The gills are at first white, then pinkish, and finally black and dripping with inky black liquid. The stem bears a movable ring. The Shaggy Mane appears chiefly in the autumn in rich pastures, gardens, about rubbish dumps, and especially in rich, newly made lawns. The spores are black.

5. The caps of the **Uncertain Hypholoma** (*Hypholoma incertum*) are 1 to 2 inches in diameter, thin, fragile, and white or creamy white. The gills are at first white but soon become lilac-tinted or purple-brown. The spores, also, are purple-brown. It grows in troops on the ground in the vicinity of stumps and buried wood. Its season is from May to September during which time four to six successive crops may be expected if rains are frequent.

6. The **Brick-top** (*Hypholoma sublateritium*) is an autumnal species which grows in large, dense clusters on the ground about stumps and buried wood. The caps are fleshy, brick-red, and from 1 to 4 inches in diameter. The gills are at first whitish, then grayish or olive, and finally purple-brown. The spores are purple-brown.

7. The Velvet-stemmed Collybia (*Collybia velutipes*) is a cool-weather mushroom. It comes late in autumn and even during mild spells in winter. The caps are yellowish red, about an inch in diameter, and very viscid when wet. They grow in dense clusters on standing dead trunks of deciduous trees, especially of elm and willow, and also on the ground around stumps. The lower portion of the stem is clothed with a dense, velvety growth of short brownish hairs. The spores are white and the gills white or creamy white.

A full account of this species has been published in Bulletin No. 448 of this Station.

8. The Oyster Mushroom (*Pleurotus ostreatus*) takes its name from the shape of its caps which is that of an oyster shell. It is found from June to September on standing dead trunks of deciduous trees; also, on stumps and logs. The caps are whitish or smoke-colored, 2 to 5 inches in width, and have very short stems which are attached at the side (lateral). They grow in dense clusters in which the caps closely overlap one another. The spores and gills are white. A very closely related species, *Pleurotus sapidus*, has lilac-tinted spores. It, also, is edible.

9. The Common Mushroom (*Psalliota campestris* or *Agaricus campestris*). This is a wild form of the common cultivated mushroom familiar to all. It should be noted that the gills are at first pink, then brown, and, finally, black. The spores are purple-brown. There is a conspicuous collar on the stem, but no sign of a cup (volva) at the base of the stem. It is found chiefly during August and September in lawns, pastures, and other open grassy places, especially in richly manured soil.

10. The Fairy Ring (*Marasmius oreades*) grows in lawns and closely grazed pastures forming arcs and circles which are conspicuous because the grass in them is taller and greener than that elsewhere. The plants are small and tough and have the property of reviving upon the addition of water even after being dry and shriveled for a long time. The caps are reddish when young or moist and cream-colored when dry. They appear after heavy rains in successive crops from June to October.

11. The Coral-like Hydnum (*Hydnum coralloides*) is not an agaric but one of the so-called hedgehog fungi. It is a beautiful, pure white, soft, fleshy fungus with a loose, complex system of branching. The branches are covered on the underside with sharp (but soft) spines which bear the spores. It is found during wet weather on prostrate tree trunks in deep woods from August to October, forming open masses several inches in diameter.

12. The Giant Puff-ball (*Calvatia gigantea*) can hardly be said to be common, yet because of its large size and striking appearance it is

too well known to need description. It often attains a diameter of 12 or 15 inches. It should be sought during August and September in grassy places in rich pastures and thin woods. There are some other kinds of puff balls but none are poisonous.

F. C. STEWART

NEW YORK STATE AGRICULTURAL
EXPERIMENT STATION GENEVA, N. Y.,
July 1, 1925.